

# Big Savings from Smart Motors

*A motor controller that cuts energy consumption highlights a selection of spinoffs for consumer, home and agricultural use*

**C**hesebrough-Pond's Inc. is a consumer-oriented company whose annual sales volume approaches two billion dollars. Headquartered in Greenwich, Connecticut, it operates 32 plants across the nation and in those plants are more than 10,000 electric motors. That's why Chesebrough's electric bill used to run as high as \$8 million a year. It will be a great deal lower this year, thanks to a company developed device that makes electric motors "smart" enough to regulate their own output and dramatically reduce the energy they use.

The device is an inexpensive, computerized motor controller that cuts power wastage by sensing a motor's load and feeding the motor only the minimum voltage it needs

to do its job. Chesebrough has developed one version for retrofitting existing motors, another for new single-phase small general purpose industrial motors, and a third for controlling large three-phase motors in industrial use.

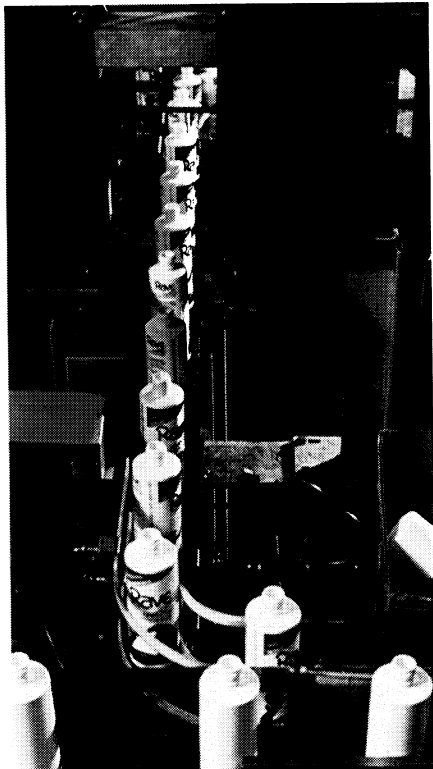
In laboratory tests, single-phase motors equipped with the controller have demonstrated energy savings as high as 90 percent. Realistically, Chesebrough expects savings in an actual plant environment to range from 10 to 50 percent, depending on the type of motor and how it is used. Even the lower figure represents a tremendous saving for industrial firms that operate as many or more motors than does Chesebrough. The company estimates that reduced electric bills

will pay back the cost of retrofitting the motors in Chesebrough plants in only two years.

What makes the Chesebrough controller development particularly interesting is the fact that the company is not an electric-motor manufacturer nor a high technology enterprise. Chesebrough-Pond's manufactures and markets consumer products; perhaps best known for Pond's skin cream, the company produces a widely diversified line ranging from Q-tips to Cutex, children's clothing to home permanents, perfume to spaghetti sauce. Chesebrough never intended to get into the controller business; it was simply looking for a way to trim its substantial electric bill and, unable to find a commercially-available



At left is a conveyor line at the Clinton, Connecticut plant of Chesebrough-Pond's Inc., where the widely diversified company manufactures such products as vaseline, hair spray and permanent lotions. The red box in the center photo is a computerized single-phase motor controller, based on NASA technology, that dramatically reduces the amount of energy required to run the conveyor line. At right is a three-phase unit, used to control larger industrial motors, in the boiler room of the Clinton plant.



controller suited to its special needs, it proceeded to invent one.

The controller traces its origin to work in the mid-seventies at Marshall Space Flight Center (MSFC) which—as part of its energy conservation research in support of the Department of Energy—was seeking a means of curbing power wastage caused by the fact that alternating current motors operate at a fixed voltage. The fixed voltage is what motors need to handle the heaviest loads they are designed to carry, but a motor usually does not operate at full load conditions; even when it is idling, it is still getting full-load voltage and, with multimillions of electric motors in the U.S., the cumulative wastage is of enormous order.

MSFC engineer Frank Nola developed a device—called the Power Factor Controller (PFC)—that matches voltage with the motor's need. Plugged into a motor, it continuously determines load by sensing shifts in the relationship between voltage and current flow. When the controller senses a light load, it cuts the voltage to the minimum needed, thus effecting large-scale savings.

In 1977, Chesebrough organized a Corporate Advanced Technology Group at Clinton, Connecticut to devise ways of improving

productivity and cutting manufacturing costs. As its major project, the group tackled energy reduction and evaluated a number of energy control devices, none of which met company requirements. In 1979, Chesebrough acquired a license for the NASA Power Factor Controller technology. The PFC, while effective in many applications, was not the answer to Chesebrough's particular needs, principally because it required many user adjustments to meet the many variable factors associated with operating electric motors in a manufacturing plant.

Chesebrough, therefore, used the NASA technology as a departure point for development of a "user friendly" smart system—a computerized motor controller that would monitor the variables, evaluate their impacts, and calculate the appropriate commands that would enable the motor to operate at maximum efficiency regardless of the motor's application or operating conditions. The key element of the controller that emerged from the Chesebrough development program is a microprocessor that does the calculations and sends the command signals. The system also employs solid state components to perform motor functions traditionally handled by mechanical parts.

Ray Davis, director of the company's Corporate Advanced Technology Group, sums up the development this way:

"The Chesebrough controller makes it possible for motors to have their own built-in control intelligence. Instead of being dumb machines, they can now be smart. Smart motors will maximize their efficiency and automatically protect themselves from environmental or user abuse. Smart motors can take data and send commands to solid state sensors and controls at speeds, and with a degree of reliability and accuracy, not possible with mechanical devices. And smart motors can monitor their own performance and warn of impending failure before it becomes a cause of critical system shutdown."

In 1980, Chesebrough completed the design of its single-phase controller and built 50 units for field trials. Twenty-five of them were installed at the company's Hospital Products Division, Watertown, New York; they have operated

continuously and successfully ever since, providing annual energy savings of 20–30 percent. The company also built and similarly field tested several models of the three-phase controller. In 1982, Chesebrough was granted a patent for the invention.

The company decided to license the technology, something it rarely does, so that American home and industrial users could benefit from a development that Chesebrough chairman Ralph E. Ward says is "too good and too important to keep to ourselves." The company has signed an agreement with National Semiconductor Corporation for manufacture and marketing of the single-phase controller; Chesebrough will similarly license production of the three-phase unit. The market potential for the single-phase system alone is estimated at \$100 million a year by the late 1980s.

